ON PHYTOPHAGIC VARIETIES AND PHYTOPHAGIC SPECIES, with remarks on the Unity of Coloration in Insects.

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DATANA MINISTRA, Drury. (Lepidoptera.)

Messrs. Grote & Robinson (*Proc.* &c. IV. p. 491) seem to be of opinion, that the black larva found on the hickory may produce a different species of *Datana* from the yellow-necked and striped larva found on the oak, the apple, &c. The objection to this hypothesis is, that a larva intermediate between these two forms, viz: with the longitudinal stripes but without the yellow neck, occurs, as I have already stated, (*Proc.* &c. III. p. 403) both on the hickory and on the oak. Mr. Lintner indeed tells me, that from the black larva found on the hickory he reared what he considers as the *D. contracta* of Walker; but from this same black larva I myself reared the normal form of *ministra*, (*ibid.*) and also other forms which approximate in some of their characters towards *contracta* Walker and towards *perspicua* Gr. Rob. In fact I have little doubt that both these last so-called species are mere varieties of *ministra*, based upon extreme specimens. For the distinctive characters, which are assigned to each of them, are not found exclusively in one set of specimens bred from one kind of larva, but occur promiscuously, with all the intermediate grades, sometimes in one set of specimens, sometimes in another, as I shall now proceed to show.

According to Walker as quoted by Morris (*Synop.* p. 247) *Datana contracta* differs chiefly from *D. ministra*, 1*st*, in having narrower front wings; 2*nd*, in the brown wing-bands being edged externally with whitish-tawny; 3*rd*, in the second wing-band being nearer the first on the hind border of the wing. As to the *first* distinctive character, I have before me, *a* Fitch's figure of *ministra*, (*N. Y. Rep.* I. Pl. iv. 3,) *b* Harris's figure of *ministra*, (*Inj. Ins.* Pl. vi. 6,) *c* 1 ♂ and *d* 1 ♀ bred by myself from the normal yellow-necked larva found on the oak, *e* and *f* 2 ♂ and *g* and *h* 2 ♀ bred from the black larva found on the hickory, and *i* one captured ♀. On the most careful measurements of all these, I find that, making the extreme breadth of the front wing 100, its proportional length is in *a* 191, in *i* 192, in *c* 195, in *b* 200, in *g* 202, in *h* 208, in *e* 211, in *f* 212, and in *d* 213. Evidently, therefore, this character is too variable, and connected by too many intermediate grades, to be of specific value. As to the *second* distinctive character, it is absent in *a*, *b* and *h*, faint in *c*, moderate in *e* and obvious in *d*, *f*, *g* and *i*.

Here again, therefore, there are too many intermediate grades to make the character worth anything. As to the *third* distinctive character, making the length of the wing 100 in each of the above, the proportional distance of the first wing-band from the second wing-band on the hind border of the wing, from centre to centre, is in *d*, *e* and *g* 5, in *c* 7, in *i* and *h* 9, in *f* 10, in *b* 15, and in *a* 16. In other words this character is proportionally three times as strong in some specimens as in others, with intermediate grades from one to another. In *perspicua* Gr. Rob. this proportional distance is equal to nothing, the first wing-band being confluent behind with the second. Yet, although this seems the most remarkable of the abnormal characters concentrated in *perspicua*, it is not enumerated by Grote & Robinson among the distinctive characters of that so-called species. It may be added here, that Walker gives it as a character of *ministra*, but not of *contracta*, that "the space between the first and second wing-band is a little darker than the wing elsewhere," whereas Fitch calls this form variety *e* of *ministra*, and in fact this character is absent in *a*, *b* and *h*, very faint in *c* and *e*, moderate in *d* and *g*, and obvious in *i* and *f;* and is said likewise to occur in *conspicua* Gr. Rob. Here again, therefore, it is impossible to draw a definite line anywhere. Moreover Walker gives it as a sexual character of the ♂ *ministra*, that it has *one* discal brown spot, and of the ♀ that it has *two* discal brown spots in the front wing. Whereas it is proved by the specimens now before me, that the presence or absence of one or both discal spots is not a sexual character at all. Evidently this author has described, not the *species*, but the *individual*, and must have worked on a very limited number of specimens.

According to Messrs. Grote & Robinson *D. conspicua* "may be quickly distinguished from the hitherto described species of the genus, 1*st* by its more yellow color, 2*nd* by the narrow anterior wings, 3*rd* by the transverse lines not bordered with paler shades, 4*th* by the produced apices [of the front wings], 5*th* by the obsolete irrorations [of the front wings], 6*th* by the wider terminal space and the more crowded transverse lines." (*Proc.* &c. IV. p. 490.) To take up these characters in order, 1*st* in a colored impression of Mr. Grote's figure of *perspicua*, obligingly furnished to me by that gentleman himself, the color of the front wing is only a shade or two yellower than in *c* and *g*, and Fitch correctly states that in *ministra* "the fore wings vary from pale buff yellow to russet and auburn brown." (*N. Y. Rep.* I. p. 239.) 2*nd*. Taking Mr. Grote's figure of *perspicua* as correct, and making the extreme breadth of its front wing 100, its proportional length is only

208, or considerably *less* in proportion, instead of *much more*, than it is in *e*, *f* and *d*. (See above under the first distinctive character of *contracta*.) *3rd*. See above under the second distinctive character of *contracta*. *4th*. In the figure of *perspicua* the apex of the right front wing is scarcely produced at all, and that of the left front wing but very slightly. In *h* they are produced fully as much as in the above figure, and in *i* the right wing is produced a great deal more, with a deep excavation behind the apex, and the left wing not at all, with no excavation whatever behind it. *5th*. In *d* the irrorations are obsolete, and subobsolete in *c*. *6th*. Making the length of the front wing 100, the proportional distance from the middle of the terminal fringe to the middle of the subterminal wing-band, from centre to centre, is in *g* 15, in *i* 17, in *a* and *b* 18, in *e* 19, in *c*, *d* and *f* 20, and in *h* 22. In *conspicua*, according to Mr. Grote's own figure, it is only 21, or *less*, instead of *much more*, than it is in *h*. Consequently all the above distinctive characters are connected by intermediate grades, and therefore worthless. Neither is it true, as is stated in the description of *perspicua*, that *ministra* differs from *perspicua* in the brown color of the anterior part of the thorax always "extending unicolorously over the prothorax." For in *d* and *g* the anterior part of the brown patch is distinctly ferruginous, and in *f* and *i* it is less obviously so. Indeed Fitch describes *ministra* as having always "the fore part of the thorax bright orange or tawny yellow, this color being deeper or brownish towards its posterior edge." Like Mr. Walker, Messrs. Grote & Robinson seem to have had but a very poor supply of material to work on.

On the whole, even in the few specimens now before me, the above characters are so inextricably intermixed, that if *contracta* and *perspicua* are distinct species, then every one of the seven specimens before me must also be a distinct species. The truth of the matter seems to be, that *ministra* is a very variable species, and that collectors, as they usually do, have seized hold of a few extreme varieties and forwarded them to systematists, who have thus been deceived into treating those extreme varieties as species. *Datana conspicua* is confessedly founded upon a single specimen, and we have but to refer to Dr. Fitch's *Vanessa Lintnerii* and *Nathalis Irene*, in order to perceive how dangerous it is to found new species upon solitary specimens of variable species. As to the former species, Dr. Morris concedes that it is probably a variety of *Antiopa*. As regards the latter, a few years ago *Nathalis Iole* swarmed near Rock Island; and I took in profusion in company with each other all the intermediate grades between the normal *Iole* and Fitch's *Irene*, and many other varieties besides. Indeed Mr. Edwards, to whom I have forwarded most of the above varieties, expressly asserts that " *Irene* Fitch is simply *Iole* with a trifling variation." (Morris *Synop.* p. 351.) Just in the same way Dr. Harris made five species out of the very variable Orthopterous *Tetrix ornata* Say, and Dr. Fitch has made three species of the Homopterous genus *Athysanus—variabilis*, *fenestratus* and *minor*—out of a single wonderfully variable one, which I have found in profusion on the same birch tree in the three forms quoted as species by Dr. Fitch, together with all the intermediate varieties, and enough others, not noticed by Dr. Fitch, to make a dozen species as good as his.

Taking all the facts into consideration, I do not think that we are entitled to assume that the black larva found on the Hickory is what I have called a Phytophagic Species—i. e. that it has ceased to intercross commonly in the imago state with the normal form found on other trees —but only that it is a Phytophagic Variety. In the course of an indefinitely long time, it may perhaps cease to intercross with the normal form; and then by the Laws of Inheritance the distinctive characters, which are now connected by intermediate grades, will cease to be so connected, and the Hickory form will become to all intents and purposes a true (Phytophagic) species. We find a good exemplification of this stage in the process in the following species.

HALESIDOTA* TESSELLARIS Sm. Abb. (=ANTIPHOLA Walsh) and H. HARRISII Walsh (=TESSELLARIS Harris *non* Sm. Abb.) (Lepidoptera.)

I have this year carefully compared several dozen larvæ of the above two (Phytophagic) species, and find that the mature and nearly mature

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*As to the orthography of this genus, Mr. Grote has the following remarks:—"Mr. Walker, in transcribing the generic name *Erinnyis* from Hübner, has altered it to *Erinnys—for what reason I know not.* As is the case with *Halisidota* and *Amplypterus*, which read *Halesidota* and *Amblypterus* in the Cat. B. M., *I presume it is the result of a simple error of transcription.*" (*Proc.* &c. V. p. 79.) Clearly, in all these three cases, it is no casual error of transcription, but a rectification of Hübner's bad Greek. Authors of course are at perfect liberty to coin gibberish generic names; and so far as my own private tastes are concerned, I infinitely prefer a good, sonorous, gibberish name, such as *Rembus, Clambus, Agabus, Datana, Nadata*, &c., to the general run of would-be Greek ones. But when a generic name is manifestly intended to be Greek—and more especially when a Greek derivation is printed along with it, so as to prevent us, which we should otherwise often do, from considering it as gibberish—most writers conceive that they are at liberty to spell it correctly, and reduce it to individuals of each differ constantly by the characters given in the following Table. The very young larvæ, i. e. .15—.20 inch long, are scarcely distinguishable, being each of them without any pencils, and each of them having the head yellowish-white, but rather yellower in the former than in the latter, and the dorsal integument yellowish-white, with the warts brown-black as in the mature *Harrisii*. But so soon as ever they obtain pencils, which is probably after the first moult, the two middle pencils on segment 3 are invariably black in *tessellaris* and invariably orange-color in *Harrisii*, although occasionally in individuals, which are less than half grown, the other colored pencils incline more or less towards white. The color of the hair is, as I formerly supposed, normally white in *Harrisii*, but a few individuals occur with the hair of a dirty white like that of the normal *tessellaris*. On the second segment there is in *Harrisii* but a single distinct white pencil under each orange one, the second white one, which is very distinct in *tessellaris*, being confounded with the long hairs overhanging the head. (See *Proc.* &c. III. p. 414.) And the white pencil on segment 12 is much less obvious in *Harrisii* than in *tessellaris*, and generally almost obsolete, being confounded with the long hairs overhanging the anus.

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something like a grammatical form. Some years ago the Editors of Silliman's Journal, having occasion to rectify the orthography of one of Prof. Owen's scientific terms, which was manifestly intended for Greek, observed that it was right and proper to do so, however long and universally the term had been in use.

Even authors who maintain, that under no circumstances is it allowable to change a single letter in a published name, unless that name be preoccupied, do not always practice what they preach. For example, Osten Sacken, who avows this doctrine as the true scientific faith, has recently omitted the letter *q* (*quercus*) in the specific names of a whole host of the *Cynipidæ* of the Oak, professedly "because this addition seems perfectly useless." (*Proc.* &c. IV. p. 344.) It may perhaps be useless, as applied to the *insect*, but as applied to the *gall*, which is usually designated by the specific name of the gall-maker, it seems to me to answer a very useful and desirable purpose, *i. e.* to specify on what genus of plants the gall grows. Otherwise who is to distinguish between the Cynipidous gall "[Q.] tubicola O. S.," which grows on an Oak, and the Cecidomyidous gall "Tubicola O. S.," which grows on a Hickory? But be this as it may, if we have no right to change *Amplypterus*, which is impure and barbarous Greek, into *Amblypterus*, which is pure Greek and means "obtuse-wings," we certainly have no right to change *Cynips q. forticornis*, which is neither preoccupied nor grammatically objectionable, into *Cynips forticornis*. We might just as reasonably change such elegant specific names as *acerifoliella* (maple-leafling) and *rhoifructella* (sumach-fruitling) into *foliella* and *fructella*.

	H. tessellaris, mature larva.	H. Harrisii, mature larva.
Head	black.	rufous.
Dorsal integument	greenish-black,	yellowish-white, with the warts and a ring round each spiracle brown black.
The two middle pencils on segments 2 and 3	black,	orange color.
The two pencils on segment 11	black,	milk-white.

Now if, in the imagos of any two insects, we found constant distinctive characters one-quarter as strong as the above, no entomologist would hesitate for a moment to pronounce them distinct species. For example, *Colias Philodice* Godt. is universally, and with justice, allowed to be distinct from *C. Eurytheme* Bdv., although the only constant character that separates them is, that the first has sulphur-yellow wings and the last orange-colored wings. Yet how slight is the difference between sulphur-yellow and orange-color in these two species, when compared with the difference between the black pencils of *tessellaris* and the orange-colored or milk-white pencils of *Harrisii!* And how can we consistently rely upon a single constant character to separate two imagos, if we refuse to acknowledge the validity of four constant distinctive characters to separate two larvæ?

It is easy to say that one of these two forms is a mere "larval variety" of the other; (see *Proc.* &c. III. p 536;) but those who use such language misunderstand the very meaning of the term "variety." True it is that many larvæ vary astonishingly; but then in their case, as in every ordinary variety, we find the intermediate grades also. While here, as regards the four distinctive characters pointed out above, out of scores of specimens of the mature or nearly mature larvæ that I have examined, I have not found a single one that presented any intermediate grade whatever.

No entomologist hesitates to consider two imagos as distinct species, merely because the larvæ are undistinguishable. In many families, indeed, e. g. *Cynipidæ*, *Apidæ* and *Muscidæ*, very many larvæ bear so close a resemblance to each other, that he would be a bold man who pretended to distinguish them. Why then refuse to consider two well characterized larvæ, like *tessellaris* and *Harrisii*, as distinct species, merely because their imagos are undistinguishable? Why lay all the stress upon the characters of the imago, and none at all upon those of the larva or pupa? This is as irrational, as if an entomologist were to cut off and throw away the wings and legs of every imago which he is studying, and persist in classifying it from the consideration of its body alone; much in the same way as Conchologists used formerly to neglect and undervalue all the soft parts of a Mollusk, and decide on its systematic affinities only from the characters of its shell.

But although it is difficult to assign any good reason for making the imago the sole criterion of specific identity, it may be readily understood how the practice originated. The imago is easily preserved so as to retain its characters unimpaired; the larva is preserved with difficulty, and frequently cannot be preserved at all without losing its shape and its color. The imago may be collected vicariously, and studied in the closet a thousand miles from its habitat; in order to study the larva, the naturalist must, in many cases, go forth personally into the woods and the fields, and contemplate the living animal on the very spot of ground where, and at the very time of year when, it is to be met with. Hence the imago with many systematists has become everything, the larva and pupa nothing. But if it so happened that larvæ were easily preserved in cabinets, and imagos with difficulty, then it is not improbable that closet-naturalists would neglect and undervalue the characters of the imago, just as many of them now neglect and undervalue those of the larva. Genera and species would then be characterized almost exclusively from the consideration of the larva, just as they now are characterized almost exclusively from the consideration of the imago; and entomologists would be no more disconcerted at finding two distinct species undistinguishable in the imago, than they now are at finding two distinct species undistinguishable in the larva state.

On the general principle that, whenever two insects differ by constant and well-marked characters in any of their states, whether egg, larva, pupa or imago, they must be specifically distinct, unless they be the sexes or other dimorphous forms of one and the same species, the case of *tessellaris* and *Harrisii* might be rested here. But there is additional evidence of their specific distinctness. The former occurs upon a great variety of trees—oak, basswood, elm, hackberry, hickory, thorn, soft maple, and, according to Abbot, on beech, hornbeam, and plum—but never, as I have this year carefully noticed, upon sycamore, (platanus;) the latter occurs exclusively upon sycamore. At first sight we might account for these facts, upon the hypothesis that the colorational peculiarities of *Harrisii* are due to its feeding upon sycamore; and that if a young *tessellaris* were fed upon sycamore, it would gradually, as it approached maturity, pass into *Harrisii;* in other words, that the two so-called species are mere Phytophagic Varieties. But experiment demonstrates the fallaciousness of this supposition. I have this year succeeded in forcing two out of twenty-seven *tessellaris* to feed upon sycamore for about forty days, till they finally spun up; yet to the very last they retained all their own distinctive characters, and showed not the slightest disposition to assume those of the other species. What is very remarkable, out of forty-three *Harrisii* that I fed this year upon oak, not a single one lived to spin up; but so long as they remained alive in the breeding-cage, which was on the average about five days, the only approximation that they made towards *tessellaris* was, that their hairs (not their pencils) generally became of a dirtier white.

In order to judge of the effects of food upon these two insects, I have this year tried the following experiments under precisely similar conditions, and with every possible precaution to guard against error. 1*st*. I fed upon oak a lot of *tessellaris* found upon Oak, in Breeding-cage No. 3. 2*nd*. I fed upon Oak a lot of *tessellaris* found partly on Thorn, partly on Basswood, and partly on Hickory, in Breeding-cage No. 4. 3*rd*. I fed upon Sycamore a lot of *tessellaris* found partly on Oak and partly on Basswood, in Breeding-cage No. 5. 4*th*. I fed upon Oak two distinct lots of *Harrisii* found upon Sycamore, in Breeding-cages Nos. 6 and 7. An accurate record was kept of the phenomena presented by each lot, which, for the sake of brevity and for the convenience of comparisons, has been reduced to the following tabular abstract. About three-fourths of the larvæ in each lot were quite young, ranging from .30 to .50 inch in length, and scarcely any were admitted that appeared to be more than half grown.

HALESIDOTA TESSELLARIS.

	Number of larvæ fed.	Percentage found in Breeding-cage			Average* number of days when found		
		dead	missing	spun up	dead	missing	spun up
No. 3 Retained on Oak	20	15.0	50.0	35.0	5.0	16.1	29.9
No. 4 Shifted on to Oak	23	0	86.9	13.1	0	17.1	33.7
No. 5 Shifted on to Sycamore	27	11.1	81.5	7.4	5.7	5.7	40.0
HALESIDOTA HARRISII.							
No. 6 Shifted on to Oak	23	47.8	52.2	0	5.4	2.5	0
No. 7 " " "	20	30.0	70.0	0	4.7	4.3	0

*I give here and elsewhere what is, strictly speaking, the average number, and not the medium number. The two things are often confounded together, but are quite different. For example, if one larva dies in 4 days and three die in 8 days, the *average* number of days is seven, but the *medium* number is six. I suspect that certain writers, who profess to give the average dimensions of insects, give, in reality, nothing but the medium dimensions. To calculate the average dimensions of forty or fifty specimens, requires that every one of the forty or fifty should be measured. To calculate the medium dimensions, all that is necessary is to measure the smallest and the largest.

Hence we may conclude 1*st*, that *tessellaris* may, without very material injury to its health, be shifted on to Oak from the other trees on which it naturally feeds; for although, of those that were retained on Oak, a much larger percentage spun up than of those that were shifted on to Oak from other trees, yet a considerable percentage of the former, and none whatever of the latter, died in confinement. 2*nd*. That Sycamore is not a congenial food for *tessellaris;* for a considerable percentage of those fed on Sycamore died in confinement, and but a small percentage spun up. 3*rd*. That Oak is abhorrent to *Harrisii* as a food-plant.—It may seem strange at the first view, that *tessellaris* can be compelled to feed upon Sycamore up to the time of its assuming the pupa state, and *Harrisii* cannot be compelled to feed for any length of time upon Oak; but when we consider that in a state of nature the former is polyphagous and the latter monophagous, our surprise will cease. It is not that *Harrisii* does not eat the oak-leaves furnished to it—for the quantity of excrement on the floor of the Breeding-cage at each shifting and cleaning out proved that it must eat them—but that, having eaten them, it either perishes of disease superinduced by the unnatural food, or bores its way out in despair through the millinet of the Cage, or devours its own brethren in default of its natural food-plant.

It will be observed from the Table that in Nos. 5, 6 and 7 the average number of days when the larvæ were found missing is small, being only a little over four days; whereas in Nos. 3 and 4 it is large, being a little over sixteen and a half days. The reason of this difference is, that in the former, as soon as the larvæ were placed on the leaves, they commenced endeavoring to escape; whereas in the latter, they mostly staid contentedly on the leaves until they were full-grown, when many escaped from the Breeding-cage, probably in search of a more convenient place in which to spin up.

On the whole—however disagreeable it may be to systematists to concede, that two perfectly distinct insects may be undistinguishable in the imago state, and consequently that something more is necessary, towards the definitive establishment of specific distinctions, than the mere comparison of cabinet specimens of the imago—we must, I think, in view of all the above facts, decide that *tessellaris* and *Harrisii* do not belong to the same species. If, indeed, we first lay it down as a law, that all forms that are undistinguishable in the imago are identical, then all such facts as the above will go for nothing. But to do this is merely begging the question and arguing in a vicious circle. We might just as reasonably first lay it down as a law, that all imagos that have abdomens of the same size, shape and color are identical, and then torture Nature to fit the Procrustean bed, which we have predetermined in our own minds that she shall lie upon, whether or nay.

There is a partial parallel to the case of these two *Halesidota* in the "alternate generations" of certain Radiata. "It is curious," we are told, "that while very dissimilar Jelly-fishes may arise from almost identical Hydroids, we have the reverse of the proposition, in the fact that Hydroids of an entirely distinct character may produce similar Jelly-fishes." (*Seaside Studies* by E. C. and A. Agassiz, p. 43 and see p. 75.) Here two given lines either diverge after converging, or converge after diverging. But in *Halesidota* the lines first converge, then diverge, and then converge again. For it has been shown, that the very young larvæ of *tessellaris* and *Harrisii* are very nearly or quite undistinguishable, that the mature larvæ differ as widely as any two species of the same genus can well do, and that finally the imagos become absolutely undistinguishable.

On the supposition that *tessellaris* and *Harrisii* sprang from the same pre-existing species, and consequently that they were primordially undistinguishable in the larva state, as they still are in the imago; we may account for their larval differences by assuming, that the colorational peculiarities of the two larvæ afford them a partial protection against birds and against ichneumon-flies and other predaceous insects, and were gradually assumed on the Darwinian theory of Natural Selection. We know how many lepidopterous larvæ are partially protected from birds &c. by simulating twigs or the bark of the tree on which they live; and it is not at all impossible that the orange pencils &c. of *Harrisii* and the black pencils of *tessellaris* may be mistaken by birds and insects for a process of the particular plants on which they feed. If we reject this assumption, we can only attribute the differences of the two larvæ to what Darwin calls "Divergence of Character," superinduced by breeding "in-and-in" for ages; in the same manner as geographical varieties come to differ in process of time from one another and from the original type.

Sphingicampa distigma Walsh and Dryocampa bicolor Harris. (Lepidoptera.)

Having been fortunate enough to meet this year with three larvæ exactly similar to that which I have described as *D. bicolor*, (*Proc.* &c. III. p. 425,) I had hoped to solve definitively the question of what imago they would produce. Being confined, however, in a cage with millinet sides, they all three bored through the millinet and escaped; and I now recollect that the thirty or forty *Dryocampa*, that I have bred in different years, were all bred in a cage with sides of wire-gauze; although, singularly enough, I bred my *S. distigma* in a millinet cage, and not a single larva of some twenty that I had on hand, bored its way out. The above question, therefore, must remain for the present in abeyance; but I clearly ascertained that the *bicolor* larva is not the immature form of some other *Dryocampa*—*stigma* or *rubicunda* for example—for all my three specimens retained their peculiar colorational and structural characters up to the date of their disappearance.

ARHOPALUS ROBINIÆ Forst. Walsh and A. PICTUS Drury Walsh. (Coleoptera.)

The larva of *pictus* has been fully described and figured by Osten Sacken. (*Proc.* &c. I. pp. 121–2.) That of *robiniæ*, as I have already observed, has never yet been fully described. On June 29 I procured six of them, .55—.75 inch long, from a branch of locust one and a half nch in diameter, which they had completely honeycombed, heartwood and all. They differ in the following particulars from *pictus* as described by Osten Sacken:

1*st*. They have very distinct, though small, brown-black legs, the first pair placed halfway from the centre of the sternum to the lateral edge, and upon that fleshy, transverse fold behind the prosternum and separated by a furrow from it, which is said by Erichson to occur in all *Cerambycidæ;* the third pair on the metasternum in range with the first; the second pair on the mesosternum considerably inside of a line connecting the first and third. This latter arrangement is probably due to the thoracic spiracle being, as in all *Cerambycidæ* as distinguished from *Lamiidæ*, located on the mesothorax and so crowding the leg inwards. Each leg is conical, not quite .02 inch long, with a basal diameter of over .01 inch, and 3-jointed, with the last joint a little prolonged in a slender thorn. According to Erichson as quoted by Osten Sacken, all Longicorn larvæ, except those of *Lamiidæ*, "have feet, which, however, are sometimes so small as to be perceptible only when magnified even in large-sized larvæ." (*Proc.* &c. I. p. 119.) Yet not only does Osten Sacken describe and figure the larva of *pictus* as apod, but he expressly says that "the larva of *Arhopalus* has no feet, although belonging to the *Cerambycidæ*." (*Ibid.*) Can it be possible, that of two such closely allied species as *robiniæ* and *pictus*, one is apod in the larva state and the other has distinct feet? Or are the feet microscopically minute in *pictus*, so that they were inadvertently overlooked by Osten Sacken? *

2nd. When alive these larvæ were not at all clavate in front, neither were the thoracic segments flattened above and below, as the larva of *pictus* is described and figured by Osten Sacken, most probably from alcoholic specimens. Yet after being immersed in alcohol for three and a half months, both these characters made their appearance, although the prothorax is still, as compared with the middle abdominal joints, only as thirteen to eleven wide, even in the most strongly clavate specimens, whereas Osten Sacken figures that of *pictus* as in the proportion of thirteen to seven. Since, however, he describes the prothorax of *pictus* as "twice broader than long," which is also true of *robiniæ*, the above difference is probably due to his specimens having been preserved in too strong alcohol, so as to shrivel up the abdomen unduly.

3rd. When recent, the prothorax is not "brownish-yellow," but whitish like the rest of the body, with four transversely arranged, roundish, brownish-yellow, dorsal spots. In the alcoholic specimens, the entire body assumes a more or less brownish tinge on the dorsal and ventral surface, which is less obvious laterally; but even then the prothorax is usually no darker than the rest of the body.

Besides the above two (Phytophagic) Species, there is a third species

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* Baron Osten Sacken has obligingly sent me one of the larvæ from which his description was drawn, and which, as he says, was communicated to him by Dr. Horn, "along with the pupa and the recently escaped imago;" and it absolutely has no feet at all and no vestiges of any feet, under the most powerful lens. Now, even if we assume that Dr. Horn was mistaken as to the identity of his larva, which, as Baron Osten Sacken well suggests, can scarcely have been the case, to what imago could it pertain? If it pertained to any other Cerambycide—e. g. *Chion garganicus* Fabr. which is our commonest hickory borer—then there is the same anomaly of a Cerambycidous larva without any feet. If it pertained to a Lamiide—e. g. *Monohammus tigrinus* DeGeer, which, according to Dr. Fitch, commonly inhabits the hickory in Pennsylvania—then we have the other anomaly of a Lamiidous larva with its thoracic spiracle, not where according to Erichson it ought to be, viz: in the fold between the pro- and mesothorax, which fold as it bears the front legs in *robiniæ* must necessarily be prothoracic and not mesothoracic, but on the side of the mesothorax as in *Cerambycidæ*. For not only does Osten Sacken describe his larva as having the "spiracles normal," but I see with my own eyes that its thoracic spiracle is on the side of the mesothorax. On the whole, I incline to believe that the larva of *A. pictus* is really apod, and that of *A. robiniæ* really 6-footed; but as this is so remarkable an anomaly, it would be very desirable to verify the facts by further observations. Mr. Cyrus Thomas describes a larva found in locust wood, which he supposes to be that of *A. robiniæ*, as having "six very minute feet." (*Trans. Ill. State Agr. Soc.* V. p. 430.)—Dec. 16, 1865.

of *Arhopalus*—the *infaustus* of LeConte, as kindly determined for me by that author himself—the ♂ and ♀ of which are as much alike as those of *robiniæ*, and scarcely differ from my specimens of that species ♂ ♀, except in the yellow bands being nearly twice as wide and the antepenultimate one at the tip of the elytra nearly thrice as wide, and in the legs being brown-black instead of ferruginous. With the exception, however, of the antepenultimate one, the yellow bands of this species are no wider than in Harris's figure of *robiniæ*. (*Inj. Ins.* Pl. II. 10.) Besides the above colorational characters, there is a very slight, but constant, structural character which distinguishes *infaustus* both from *pictus* and from *robiniæ*. In the former ♂ ♀ the antennal joints 2 and 3 are together $\frac{1}{4}$—$\frac{1}{3}$ *shorter* than joint 1; in the two latter species ♂ ♀ they are *equal* to joint 1. Of *infaustus* my friend Dr. Velie took in the middle of September, 1864, eight ♂ four ♀ on the Platte River in Colorado, near Baker's Ranch; and as both he and Dr. Parry, the Iowa botanist, agree that there were no trees but cottonwoods growing within a great many miles of that locality, the presumption is that that insect inhabits the cottonwood. In that case we have here a third (Phytophagic) Species belonging to this group, which agrees with *robiniæ* in all the six ♂ characters that separate that species from *pictus*, (*Proc.* &c. III. p. 421,) and also in the time of the appearance of the imago; but differs ♂ ♀ as specified above from *pictus* ♂ ♀ and *robiniæ* ♂ ♀, and also in its food-plant.

CALLIDIUM ANTENNATUM Newman (=violaceum Eur?) and C. IANTHINUM Lec. (Coleoptera.)

The former of these two very closely allied species lives in pine wood, according to Harris, and comes out from the middle of May to the first of June. (*Inj. Ins.* p. 100.) Of the latter, as determined by Dr. LeConte himself, Dr. Velie took ten specimens in Nebraska in the month of May in and on Red Cedar, which tree they were infesting in enormous numbers. Hence the two may be considered as Phytophagic Species. *Ianthinum* differs as follows from *antennatum* on comparison with 2 ♂ 1 ♀ of the latter received by me from the Eastern States:—

1*st*. The length (ten specimens) is .39—.45 inch instead of .55—.60 inch, or, according to Harris, .40—.60 inch.

2*nd*. The thorax is only one-third shorter than wide instead of one-half shorter.

3*rd*. The widest part of the thorax is a little *behind* the middle instead of a little *before* the middle.

4th. The sculpture above is, not only relatively, but absolutely coarser, especially on the thorax.

5th. On the pronotum ♂ there is no subpolished dorsal shield, bounded laterally by a distinct unidentate stria. Dr. LeConte informs me that this character is always met with in ♂ *antennatum*, and it is very conspicuous in both my ♂ ♂. I have been unable to ascertain, what are the characters which are supposed to separate our *antennatum* from the European *violaceum*, which also feeds on pine, and with which it was formerly confounded. The name seems to indicate that there is supposed to be some difference in the size or structure of the antennæ.

CONOTRACHELUS NENUPHAR Hbst. (Coleoptera.)

It has long been known that a race of this insect inhabits the Butternut and Walnut, which is full one-half longer and wider than the race which infests the Plum. I have met with numerous specimens of both, but never found any intermediate size. Say states, on the authority of Bartram, that this insect also "destroys the European Walnut in this country," but does not notice any difference in the size of the Walnut-inhabiting race. I conceive that the two are Phytophagic Varieties or perhaps Species, differing from each other as do the two races of *Chrysomela scalaris* Lec., which inhabit respectively the basswood and elm or the dogwood and plum. (*Proc.* &c. III. p. 403.)

DORYPHORA 10-LINEATA Say and D. JUNCTA Germ. (Coleoptera.)

I have already, in the "Practical Entomologist" (No. 1), shown that the former of these two very closely allied species inhabits plants belonging to the botanical family Solanaceæ, and especially the genus Solanum; while the latter most probably inhabits the Hickory, or at all events does not feed on Solanum. We may therefore consider the two as Phytophagic species.

Typically there are on the thorax of each of these species eighteen spots, arranged in the same very peculiar pattern, viz: two large, divergent, elongate ones arranged side by side in the middle, and respectively between and behind these a single minute one placed on the dorsal line; while on each side of this four-spotted pattern are seven small spots, five of them on the hinder part of the thorax in a quincunx narrowed in front, and the other two before this quincunx, scarcely wider apart than the two hind spots of the quincunx, and obliquely arranged, so that the outer one of the two is always twice as far from the anterior edge of the thorax as is the inner one. Now eighteen spots may be arranged in a given trapezium in an almost infinite variety of different patterns. If, then, these two species did not spring from some pre-existing form, but were created originally as distinct species, how does it come about that the same very peculiar pattern is repeated on the thorax of each? What possible necessity in that case could there be, for Nature to plagiarize from herself a merely ornamental design, when millions and millions of other designs might just as well, for anything we can see to the contrary, have been selected? I could as soon believe, with the old geologists, that dead fossil shells had been created in the rocks, on purpose to deceive us into believing that they had once been alive, as that, out of the infinity of possible patterns, a particular one had here been selected and imprinted upon two aboriginally distinct species, with the manifest result of deceiving us into confounding those two species together.

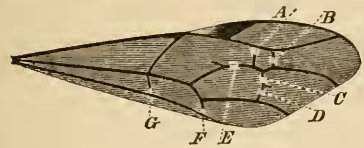
I have said that there are *typically* eighteen spots on the thorax of the above two species. Sometimes, however, six particular spots out of the eighteen are some or all of them absent, the *locus* of the remaining spots being still the same; and it is very remarkable, that in the two species it is the same particular spots that are thus absent, viz: the two minute ones on the dorsal line and the central one of each quincunx, which are often absent, and the spot in each quincunx that abuts on the hind angle of the thorax, which is but seldom absent. According to the mathematical theory of chances, this can scarcely be a merely fortuitous event; for the odds are enormously against any one's happening on the same particular six numbers, twice over, out of eighteen numbers.

It is sometimes the case also, in both the above two species, that several pairs of the thoracic spots are confluent with each other. Now we have only to imagine all of them confluent, and we get the thoracic ornamentation found in *Chrysomela bigsbyana* Kby, *C. præcelsis* Rogers, *C. elegans* Oliv. and *C. exclamationis* Fabr., viz: a dark-colored thorax bordered laterally and in front with a pale tint; and in *C. scripta* Fabr., *C. interrupta* Fabr., *C. Adonidis* Fabr., and especially in *C. multipunctata* Say, we find intermediate grades between the two forms. Nor is this an entirely imaginary idea as applied to the genus *Chrysomela*. In a series of specimens of one species of this genus, *interrupta* Fabr., as I have already observed, (*Proc.* &c. III. pp. 228–9,) we find, as regards the elytral markings, precisely the same gradations, from sixteen dark spots more or less partially confluent, to a uniform dark color bordered laterally and behind by a pale tint. Nobody doubts that these colorational varieties of the species *interrupta* have all proceeded from a common origin. Why then should we be shocked with the idea, that the similarly different colorational forms of two such closely allied genera as *Doryphora* and *Chrysomela* have, ages and ages ago, all proceeded from a common origin?

Genus ICHNEUMON. (Hymenoptera.)

There is another and a still stronger case of what I have called the "Unity of Coloration," which, as it is a very curious one, and does not appear to have been hitherto noticed or elucidated by any author, I may be excused for dilating on. In fact, colorational characters such as these, which prevail throughout several species or throughout whole genera, are usually neglected by those entomologists who occupy themselves in establishing new genera, because the commonly received opinion is that genera must be founded, not upon colorational, but upon structural characters; and by those who occupy themselves in describing new species, because, being found indifferently in many species, they are of little or no value as specific distinctions. Yet the very circumstances, that cause them to be neglected by these two classes of writers, are precisely those which render them of pre-eminent interest to the philosophic naturalist.

The annexed figure represents—magnified about three diameters—the front wing of any species of *Ichneumon* with blackish or fuliginous



wings, e. g. *viola* Cresson, *flavicornis* Cress., *saucius* Cress., *cincticornis* Cress., *scelestus* Cress., *malacus* Say, *morulus* Say, *devinctor* Say, *centrator* Say, *grandis* Brullé, or *rufiventris* Brullé. It will be observed that there are five white spots on it, *A* . . . *E*, which extend beyond the limits of the vein on which they are situated into a blister-like expanse, that has much the appearance of a spot of white mould. Besides these five, there are two minute spots, *F* and *G*, which scarcely ever extend beyond the limits of the vein on which they are located. The *locus* of all these spots is perfectly definite and never differs in any species. *A* is small and often subobsolete, and is invariably located on the internal side of the areolet, and so well forwards as to touch the radial area. *B* is large and obvious, and is invariably located on the external side of the areolet, and almost always slightly behind the middle of the cross-vein which it bestrides. *C* is large and obvious, and is invariably located about midway between the areolet and the obtuse, salient angle of the second recurrent nervure, which angle, as in the figure, often has a short stump of a vein proceeding from it. *D* is small and sometimes subobsolete, and is invariably located immediately behind this salient angle so as to touch its apex. *E* is large and obvious, and is invariably located about midway between the areolet and the obtuse, re-entering angle of the first recurrent nervure, which angle, like that of the second recurrent nervure, often bears a short stump of a vein, as shown in the figure. And *F* and *G* are minute and inconspicuous, and invariably located on the hind end of the two hindmost cross-veins, so as to touch the anal or postcostal vein.

Although three of these five blister-like spots, viz: *B*, *C* and *E*, are obvious, so far as I can find out, in every N. A. species of *Ichneumon* that has blackish wings, the other two being generally smaller and not so conspicuous, and although Mr. Cresson, on my calling his attention to the subject, kindly informs me that he notices them in many European species with blackish wings, yet they have been almost entirely overlooked by authors. Say refers to them only in his description of *I. malacus,* where he calls them "bullæ," (blisters or bubbles,) and in his description of *I. morulus*, where he calls them "white dots;" Cresson refers to them only in his descriptions of *I. Blakei* and *I. scelestus;* and Brullé does not refer to them at all. As to the minute spots, *F* and *G*, though they occur, not only thoughout the genus *Ichneumon*, but in every specimen of every species of every genus belonging to *Ichneumonidæ*, (and I might add *Braconidæ*,) that I have hitherto examined, yet I cannot find that any author has as yet taken any notice whatever of them.

But these five "bullæ" are not confined to those species of *Ichneumon* that have blackish wings. I discover that, by holding the wing up to the light, they may be detected, more or less plainly, in all the species of *Ichneumon*, at least seventy in number, that are contained in my collection, many of which have almost perfectly hyaline wings.*

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*My collection comprises *viola* Cress. ♀ (=*maurus* Cress.=*Orpheus* Cress.), *flavicornis* Cress. ♂, *malacus* Say ♀, *saucius* Cress. ♀ (=*ater* Cress.), *cincticornis* Cress. ♂ ♀, *morulus* Say ♂ ♀, *vittifrons* Cress. ♂, *scelestus* Cress. ♀, *extrematis* (*-mus?*) Cress. ♂ ♀, *unifasciatorius* Say ♂, *otiosus* Say ♂ ♀, *agnitus* Cress. ♀, *pulcher* Brullé ♂, *cæruleus* Cress. ♀ (=true ♀ of *pulcher?*), *jucundus* Brullé ♀, *Grotei* Cress. ♂, *flavizonatus* Cress. ♂, *atrifrons* Cress. ♀, *comptus* Say ♂, *paratus* Say (1836) ♂, *comes* Cress. ♂ ♀, *devinctor* Say ♀, *fuscifrons?* Cress. ♀, *pectoralis?* Say ♂, *funestus?* Cress. ♀, *centrator* Say ♀, *suturalis* Say ♀, *seminiger* Cress. ♀ (=*vicinus* Cress.), *annulipes?* Cress. ♀ (=*pusillus* Cress.), *grandis* Brullé ♂ ♀ (♂=*ambiguus* Cress., ♀=*regnatrix* Cress.) and *rufiventris* Brullé ♂ ♀ (=*semicoccineus* Cress.=*incertus* Cress.) The remaining thirty-nine species are not described either by Say, Brullé or Cresson, and are probably most of them new. As regards the synonymies given in the above list, it is proper to add here, that I do not find

On the other hand, in other Ichneumonidous genera there exist homologous spots, but often different in number or differing slightly in their location, though they are manifestly modifications of the same primordial pattern. For example in *Trogus*, where the pentagonal areolet of *Ichneumon* becomes rhomboidal by the elimination of the upper side, *A* generally covers the whole angle formed above by the union of the inner and outer sides of the areolet, and the other four bullæ are placed as in *Ichneumon*. In *Pimpla* and *Ephialtes*, which also have a rhomboidal areolet, *A* is placed above *B* on the upper end of the outer side of the areolet, and in *Pimpla* is generally separated from *B* only by a very small space, and sometimes entirely confluent with it, the other three bullæ being located in both genera nearly as in *Ichneumon*, except that *E* is usually closer to the angle of the first recurrent vein. In *Cryptus* there are normally but *four* bullæ, *C* and *D* being confluent and the others placed as in *Ichneumon*, except that *B* is located higher up on the cross-vein which it bestrides. In *Glypta*, where the areolet is represented by a simple cross-vein, *A* and *B* are absent, but as *C* and *D* are not quite confluent, being divided by a slender black line or black dot, there are *three* bullæ, *C*, *D* and *E*. *Odontomerus*, *Xylonomus*, *Acænitus* and *Arotes* differ from *Glypta* chiefly in *C* and *D* being separated by a very wide space, and have the same number of bullæ. And in *Ophion* and *Anomalon*, where the areolet is also represented by a simple cross-vein, *A* and *B* are absent, but *C* and *D* being perfectly confluent, there are consequently but *two* bullæ. So far as I can discover, on a careful examination, there is no Ichneumonidous genus

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either the shape of the "central area" of the metathorax, or the number of joints contained in the antennal annulus, a constant and reliable specific character. In very many well-marked species of which I possess numerous specimens, the width of the "central area," as compared with its length, varies 50 per cent. with all the intermediate grades, i. e. varies from "transverse" to "quadrate" or from "quadrate" to "elongate;" and in other such species the length of the antennal annulus varies very considerably, often by three or four and in one species by as much as seven joints, with numerous intermediate grades. It is even the case that in one undescribed species, allied to *parvus* Cresson, of which I possess seven ♂, a single ♂ has two or three of the intermediate antennal joints marked with yellowish-white above, while the remaining six ♂ have no such markings whatever. And Westwood records the fact that "two ♀ of *Cryptus bellosus* were reared by Mr. Thwaites, one of which had the antennæ annulated and the other entirely black." (*Intr.* II. p. 138, note.) If all specimens that differed in the above characters were considered as distinct species, the number of species in my collection would be very largely increased, and my argument strengthened so much the more.

that has not some such modification of that type of bullæ which prevails in *Ichneumon*, and none that has not at least two bullæ, viz: *C* (or *CD*) and *E*.*

Although, as I believe, the bullæ exist typically in every species of *Ichneumon* in the pattern peculiar to that genus, yet, as we might naturally expect, we occasionally in certain species meet with certain specimens, where they are partially obsolete, or undergo some other slight modification, sometimes in one wing only, sometimes in both wings of the same specimen. In order to test this question, I have carefully examined both front wings in 319 specimens belonging to the 70 species of *Ichneumon* which I possess, making in all 638 wings. Of these 638 wings as many as 75, belonging to 28 different species, have the bulla *A* obsolete; 28 wings, belonging to 15 different species, have the bulla *D* obsolete; † in one wing only of the 638, belonging to a single ♀ of *seminiger* Cress. out of 3 ♀ which I possess, is the bulla *C* obsolete; but in none whatever of the 638 are either the bulla *B* or the bulla *E* obsolete. In 5 wings out of the 638, belonging to 3 different species, where the areolet is subrhomboidal, including 1 ♂ out of 28 ♂ of *flavizonatus* Cress., the bullæ *A* and *B* are confluent above. And only in 2 wings out of the 638, viz: in 2 ♂ of *morulus* Say—a very abnormal species with metathoracic thorns ‡—out of 3 ♂ 2 ♀, is there a small additional or spurious bulla located on the side of the areolet that adjoins the discoidal cell, but only on the inside of the areolet and not extending on to the vein. In 11 out of 13 specimens of *Trogus obsidianator* Brullé which I possess, this same additional spurious bulla or rather semi-bulla makes its appearance. But neither in the three other

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*Say describes the "bullæ" by that name in *Anomalon attractus, An.* (*Odontomerus*) *mellipes, Ophion brachiator* and *Cryptus grallator;* and describes them as "white spots" in *Banchus æquatus* and *B. nervulus.* Of course, if he had been aware that these bullæ are, properly speaking, a generic character common to all the species of the same genus, he would not have given them as characters of particular species. Brullé neither names nor describes the bullæ in any of his descriptions of *Ichneumonidæ,* though his Artist has figured them *Plate* XLII, fig. 1. And Mr. Cresson tells me that "neither Fabricius nor Gravenhorst, so far as he can see, mentions the bullæ or any other term for that character."

† In several small species with hyaline wings, which I have referred to this category, the second recurrent vein is so nearly straight, that it is difficult to say, whether it is the bulla *D* that is obsolete or the bullæ *C* and *D* that are confluent.

‡ If *Hoplismenus* Grv. can be retained as distinct from *Cryptus,* which Brullé denies, then this species should also be erected into a genus distinct from *Ichneumon.*

species of *Trogus* in my collection, including *T. exesorius* Brullé, nor in any other Ichneumonidous species, so far as I have observed, except *Cryptus robustus* Cress. six ♀, and an apparently undescribed species (one ♂ one ♀) belonging to a new genus intermediate between *Joppa* and *Baryceros*, do I find any traces of this remarkable anomaly. The above is the sum total of variation, as regards these "bullæ," in 638 wings appertaining to 70 distinct species of *Ichneumon;* and it appears to be almost universally variation and not specific difference, because there is but a single instance where a species, represented by over two specimens, exhibits any given variation in both the front wings of all the specimens. That instance is *annulipes?* Cress., a very variable species, of which I possess eight specimens, no two of them exactly alike in their general coloration, and all eight of which have the bulla *A* obsolete in both wings. In 319 specimens of any given species of insect, we should be apt to find almost as great an amount of variation, as that which has been detailed above, in any given specific colorational character. And yet this particular type of bullæ is not a specific character, but one which runs through 70 distinct species of a particular genus; and as already stated, remarkable modifications of the normal bullæ of *Ichneumon* are found in all the other Ichneumonidous genera with which I am acquainted.

Besides the seven spots which, as has been already shown, exist typically in the front wing of *Ichneumonidæ*, there are usually in the hind wing two bullæ located on the lower or hindmost end of the two principal cross-veins. But for the purpose which I have in view, it is unnecessary to dwell upon this point.

I might have insisted likewise on the very general, though not universal, persistence of the pale spot at the base of the stigma throughout *Ichneumonidæ* and *Braconidæ*, and several other Hymenopterous families; and, indeed, throughout certain families belonging to other Orders. But as this character is perhaps partly structural, being connected with the thinner organization of the stigma at that particular point, for certain unknown structural or functional purposes, I have forborne taking any account of it. In the case of the bullæ, however, we cannot reasonably assume, that any structural or functional necessity could require a wing-vein to become suddenly thinner at some particular point, and then as suddenly become as thick as before; for it has been proved that the wing-veins are, properly speaking, veins, *i. e.* that they are fluid-conducting tubes. And even if we make some such gratuitous assumption, this will not explain the white blotch on the membrane of the wing, which almost always in the bullæ A . . . E, but scarcely ever in the spots F and G, adjoins the white spot on the vein itself.*

To entomologists who have worked much on any particular group or groups of insects, the facts stated above will, I suspect, seem not at all extraordinary. For many similar cases of Colorational Unity occur in every Order; and it has repeatedly happened to myself, and I doubt not to others, that, after having examined numerous species belonging to a given genus, I come at last upon one with a particular spot or a particular stripe conspicuously developed in a particular *locus*, and, on recurring to the species already examined, find more or less faint traces of the same spot or the same stripe in every one of them. But to the student in other departments of Natural History, where the number of species is so very much smaller than in Insects, and where consequently there is no such opportunity to form very extensive generalizations, the phenomena detailed above will appear, perhaps astonishing, perhaps incredible, perhaps false. They are nevertheless strictly true; and any one may easily satisfy himself of their truth, by selecting at random any species of *Ichneumon* and holding up its wings to the light under a moderately good lens.

The question naturally occurs here to the philosophic mind—What is the MEANING of all these facts? Why do the same bullæ in the same *loci* occur in so many distinct species of the same genus? Why do not some species have these bullæ located on some of their other veins, or on some other part of the same vein? Why, for example, is there never a bulla on the *basal* side of the angle of the first recurrent vein, either in *Ichneumon* or in any other Ichneumonidous genus? Why are there not sometimes six or eight or ten bullæ? Why are there not sometimes none at all? In every species of *Ichneumon* we find, it is true, without exception, a pentagonal or subpentagonal areolet and a very short ovipositor. But the reason of this is obvious. If the insect was without these characters, it would not be placed in the genus *Ichneumon*, because these are some of the established generic characters of *Ichneumon*. Yet so far is it from being the case, that the bullæ are an established generic character of *Ichneumon*, that they do not appear to have been even noticed hitherto, except incidentally in the descriptions of a few species. Look at the figure given above. Any one can see that the seven white spots on it might be arranged on the wing in millions and millions of different patterns. Why then in

* I observe that in *Thyreodon* and *Ophion* the spots F and G often extend on to the membrane of the wing, precisely as in bullæ A . . . . E.

seventy distinct species of the same genus are they always arranged in the same pattern, subject only to the very slight variations noticed above? Why—as is most likely the case—should Nature have servilely repeated the same monotonous Colorational Pattern throughout the whole genus *Ichneumon*, which probably comprises at least 500 species, and is numerously represented on both sides the Atlantic? Why in allied genera do we find curious modifications of the same fundamental pattern, and not entirely new and original patterns? Why in allied genera do we find none entirely without bullæ, and none without the spots *F* and *G?* Why is the *locus* of the spots *F* and *G* absolutely invariable throughout *Ichneumonidæ* and *Braconidæ?* If these seven spots could answer any possible utilitarian purpose, we might say that they occur throughout *Ichneumon*, because the peculiar habits of that genus require them for that purpose. But they are manifestly mere ornamental designs, in no possible respect necessary or useful to the individual *Ichneumon*, any more than the numerous small, pale spots on the bodies of many adult Fallow Deer, which occur also in the fawn of the common North American Deer, are necessary or useful to the individual Deer.

To my mind, there can be but one satisfactory answer to all the above questions. There MUST be a close genetic connection between all the species of the genus *Ichneumon*, and a more remote genetic connection between that genus and the other genera of *Ichneumonidæ*. "Community of descent," says Darwin as interpreted by Lyell, "is the hidden bond which naturalists have been unconsciously seeking, while they often imagined that they were looking for some unknown Plan of Creation." (*Antiq. Man.* p. 412, Amer. ed.) Let him, who refuses to accept this solution of the enigma, offer a better solution himself.

——— Siquid novisti rectius istis,
Candidus imperti : si non, his utere mecum.

But do not let him utter sonorous common-places, about carrying out the Plan of Creation and completing the System of Nature, and then fancy that he has explained facts, when in reality he has only re-stated them in general terms.

ROCK ISLAND, ILLINOIS, NOV. 15, 1865.